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# The Welfare Effects of Private Sector Participation in Guinea's Urban Water Supply

*George Clarke**Claude Ménard**Ana Maria Zuluaga*

Private sector participation in Guinea's urban water sector has benefited consumers, the government, and, to a lesser extent, the new foreign owners. Performance will improve further when the government starts paying its own water bill on time and when the legislature authorizes the collection of unpaid bills from private consumers.

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## Summary findings

In 1989 the government of Guinea enacted far-reaching reform of its water sector, which had been dominated by a poorly run public agency. The government signed a lease contract for operations and maintenance with a private operator, making a separate public enterprise responsible for ownership of assets and investment. Although based on a successful model that had operated in Côte d'Ivoire for nearly 30 years, the reform had many highly innovative features.

It is being transplanted to several other developing countries, so Clarke, Ménard, and Zuluaga evaluate its successes and failures in the early years of reform. They present standard performance measures and results from a cost-benefit analysis to assess reform's net effect on various stakeholders in the sector.

They conclude that, compared with what might have been expected under continued public ownership, reform benefited consumers, the government, and, to a lesser extent, the foreign owners or the private operator.

Most sector performance indicators improved, but some problems remain. The three most troublesome areas are water that is unaccounted for (there are many illegal connections and the quality of infrastructure is poor), poor collection rates, and high prices.

The weak institutional environment makes it difficult to improve collection rates, but the government could take some steps to correct the problem. To begin with, it could pay its own bills on time. Also, the legislature could authorize the collection of unpaid bills from private individuals.

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# **The Welfare Effects of Private Sector Participation in Guinea's Urban Water Supply**

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## 1 Introduction

In 1989, the Government of Guinea enacted a far-reaching reform of its urban water sector, which until that time had been dominated by a poorly run public agency. The government signed a lease contract for operations and maintenance with a private operator and made a separate public enterprise responsible for ownership of assets and investment. Although it was based upon a successful model that had been operating in Côte d'Ivoire for nearly 30 years and similar reforms have since been enacted throughout Africa, at that time, the reform was highly innovative. Indeed, the World Bank, which was heavily involved in advising the government on design and implementation, had to implement new internal procedures to handle the institutional structure. Because this model is being transplanted to other developing countries, a thorough evaluation of the successes, and failures, in the early years of reform will be invaluable for policymakers throughout the region and in other developing countries.

It is important to keep in mind that the reform was enacted under very difficult circumstances. The public agency, the *Entreprise Nationale de Distribution de l'Eau Guinéenne* (DEG), which was in charge of the sector before reform, was inefficient, overstaffed and virtually insolvent. Fewer than 40 percent of Conakry residents had access to piped water – low even by regional standards.<sup>1</sup> Further, service was intermittent, at best, for the lucky few with connections. Many residents drank polluted well water and even more relied upon it as a secondary source of drinking water when the piped system was not operating. By 1983, Conakry residents had to line up at neighbors connections and standpipes for hours hoping for service. After several years of discussions and delays, the government instituted a major reform, which introduced significant private sector participation in the sector.<sup>2</sup> At the same time, a large World Bank-led project, the Second Water Supply Project, was initiated to allow expansion of the system.

In this paper, we evaluate the success of the institutional arrangements in the first eight years following reform. In addition to standard performance measures (e.g., productivity and profitability), we present results from a cost-benefit analysis proposed by

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1. According to a UNDP-World Bank survey from 1992, approximately 27 people used each connection including family, neighbors, etc. (Durany and Morel à l'Huissier, 1994, p.19). If anything, this might overestimate the number of people with access to piped water – the technical director of SONEG estimated only about 15 persons per connection. Using the higher number (27 people per connection), an estimate of 1,000 people per standpipe (based upon the average number of people per standpipe in 1992 from Durany and Morel à l'Huissier, 1994) and population figures from United Nations (1996), this implies a coverage rate of 38 percent in 1989.

2. See Clarke and Ménard (2000a) for a discussion of the political economic situation concerning reform.

Jones et al. (1990) and Galal et al (1994). This allows us to assess the net effect of reform on the different parties involved in the sector. Although there have been some problems, we conclude that, compared to what could have been expected under continued public ownership, reform benefited consumers, the government and, to a lesser extent, the new foreign owners.

The paper is organized as follows. In Section 2, we briefly describe the situation before reform, including sector organization and performance. In Section 3, we describe the effect of reform on sector and enterprise performance. In Section 4, we describe the cost-benefit analysis. In particular we describe how we constructed a counterfactual scenario, which specifies what would have occurred if reform had not taken place. Although this is speculative, any discussion of the effects of reform has to make, at least implicit, assumptions about whether changes that occurred were due to reform or not. By specifying a counterfactual, we make these assumptions explicit. We also discuss the short projection period. In Section 5, we describe the results from the cost-benefit analysis and the sensitivity analysis that was conducted making different assumptions in the counterfactual scenario. The final section concludes. Except where explicitly noted all performance measures refer to national operations, since both the private company and the public enterprise produce only national accounts. Although assessing the affect of reform on Conakry alone would make the study more comparable with the other case studies in this project, the detailed data needed to do this is not available.<sup>3</sup> However, since consumers in Conakry accounted for 86 percent of water billed and 73 percent of private connections over the period studied, we expect these results to reflect the effect of reform on Conakry residents reasonably well.

## **2 Sector Performance and Organization before Reform**

According to a consultants report from 1985, there were 8,990 legal connections to Conakry's water system at the end of 1983, for a city with about 800,000 residents. In comparison, Abidjan, which was about twice the size of Conakry and had a long history of private participation in the sector, had over 90,000 connections (SODECI, 1986). Most private connections were a single tap inside a lot or compound – only a small wealthy minority had running water inside their homes (Durany and Morel à l'Huissier, 1994, p.19). Deputies, senior civil servants and DEG employees were entitled to legal, but unregistered (and unbilled) connections and there were many illegal connections. In principle, water distribution was metered and consumers were charged according to consumption but, in fact, metering was very rare. The lack of metering makes it difficult to estimate how high

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3. The other case studies are Argentina (Alcazar, Abdala and Shirley, 2000); Chile (Shirley, Xu and Zuluaga, 2000); Côte d'Ivoire (Clarke and Ménard, 2000b); Mexico (Haggarty, Brook and Zuluaga, 1999); and Peru (Alcazar, Xu and Zuluaga, 2000).

unaccounted-for-water (UFW) was, with estimates varying between 35 percent and 60 percent.

Most non-connected residents relied upon neighbors' connections or water from wells. In 1992, 29 percent of Conakry residents used well water as their primary source of drinking water. Further, about 50 percent of people with access to piped water used well water as their primary alternate source of drinking water when the system was not working (Durany and Morel à l'Huissier, 1994). Because the sewerage system was underdeveloped, well water was heavily polluted. In 1992, 80 percent of households relied upon primitive sewerage facilities in their courtyards.<sup>4</sup> Sludge from the pits attached to these facilities leaks into the phreatic layer from which households draw well water.

The water supply system is not underdeveloped due to scarcity. Rainfall is plentiful and although water from the highly polluted (and saline) aquifer under Conakry is unsuitable for drinking, the huge reservoir at Grandes Chutes could provide sufficient water to satisfy Conakry's needs.<sup>5</sup> Including water available at the outlet of power plant the reservoir could potentially produce over 500,000 m<sup>3</sup>/day (World Bank, 1989), whereas, even by 1996, billed consumption was only about 30,000 m<sup>3</sup>/day.<sup>6</sup> Although plenty of raw water was available, DEG's productive capacity was far lower than potential production. Average production from Grandes Chutes, which was constrained by the size of the pipeline from the dam to the city and treatment facilities, was only 44,000 m<sup>3</sup>/day.<sup>7</sup>

The public agency, the *Enterprise Nationale de Distribution de l'Eau Guinéenne* (DEG), that was in charge of the sector was a department of the Ministry of Natural Resources and Environment (MNRE). Although, in theory, it could act as an autonomous agency and, under its statutes, had a board containing representatives from several ministries, in practice, its board never met and MNRE treated it would any other department (World Bank, 1989, p.2). Consequently, DEG had no autonomy and suffered from many of the problems that plagued the rest of the civil service. For example, the

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4. 21 percent of these facilities are simple unlined pits, 39 percent are pits lined with cement, and 29 percent consist of two separate pits that are only rarely connected to a cesspit (Durany and Morel à l'Huissier, 1994, p.19).

5. World Bank (1989) also notes that the complex geography of the Conakry peninsula makes it difficult to abstract significant amounts of water from boreholes.

6. Although potential production was high, actual productive capacity was limited by the transmission pipeline from the Grandes Chutes dam, which could carry only 45,000m<sup>3</sup>/day. Additional water was available from the Kakimbon well field (7,000m<sup>3</sup>/day) and Kakloulima Springs (2,000m<sup>3</sup>/day).

7. World Bank (1987) and World Bank (1998). An additional 10,000m<sup>3</sup>/day is available from other sources (World Bank, 1989).

government's policy (in the early 1980s) of guaranteeing employment to university graduates meant that DEG, like the rest of the civil service, was extremely overstaffed. By 1984, DEG had 504 employees, a ratio of 34 employees per 1,000 connections (World Bank, 1987, p. 38). Even compared to other public water utilities in West Africa this was high.<sup>8</sup> Further, because salaries were low, and often not paid, DEG employees had little or no incentive to do their jobs.

The poor state of the DEG's accounts makes it very difficult to accurately assess DEG's financial performance before privatization. The 1985 consultants' report concluded that DEG's poor accounting practices, the non-availability of most relevant data, and the division of DEG's budget between several different ministries, made it impossible to even perform an audit. Similarly, in 1989, the World Bank (1989) concluded, "the shortcomings of DEG's accounting systems are such that they largely preclude attempts to observe trends and base forecasts" (p. 19). However, keeping in mind the limitations imposed by the poor quality of data, DEG's financial performance appears to have been very weak. By 1984, DEG owed over US\$4 million in unpaid interest and was over US\$14 million in debt. Very few private customers willingly paid for water and many were not billed at all.<sup>9</sup> Since the private billing and collection rates were so low, DEG managed to continue to operate only because the Government generally paid its water bill and sometimes provided large subsidies. Even this source of funds was unreliable and non-payment by the government led to frequent conflict with donors.<sup>10</sup>

Even if DEG had operated efficiently and collected billed amounts from customers, tariffs were too low to cover costs. Before June 1986, when tariffs were increased to GF 60/m<sup>3</sup> (\$0.12/m<sup>3</sup>), water tariffs were GF 10/m<sup>3</sup> (\$0.02/m<sup>3</sup>). Even after the increase, the price was considerably lower than prices in other West African countries (see **Figure 1**) and far lower than estimates of long-run marginal cost.<sup>11</sup>

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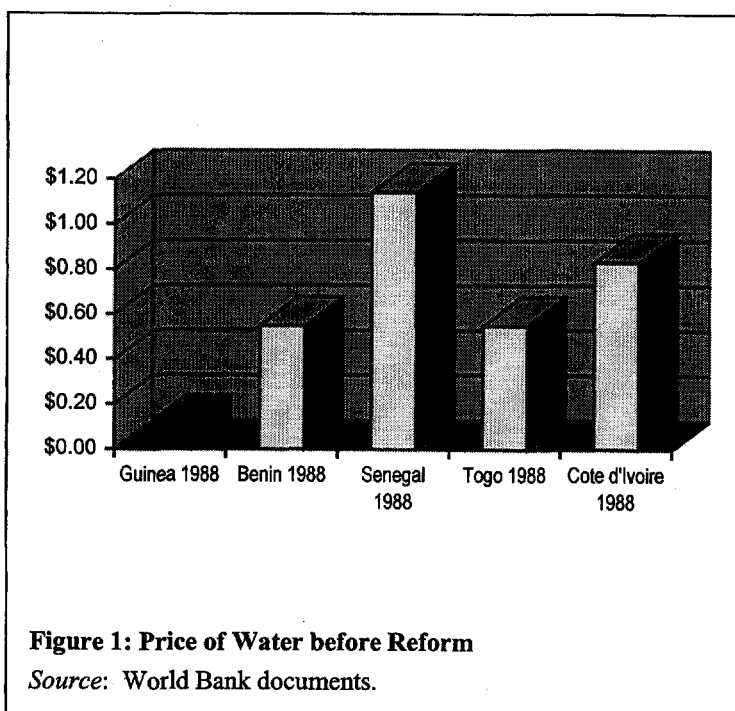
8. There were 32 and 24 employees per 1,000 connections, respectively, in the public utilities in Togo and Benin at this time. The private operator in Côte d'Ivoire had only 9.8 employees per 1,000 connections at that time (SODECI, 1986).

9. The 1985 consultant report estimated that less than 12 percent of private users were billed in 1982. Even the few customers that were billed generally did not pay. In 1987, DEG issued bills for approximately GF 800 million, but collected only about GF 100 million (World Bank, 1989, p. 2).

10. For example, in the late 1980s, the World Bank waived provisions for a structural adjustment loan that had required the administration settle its water and electricity bills promptly (World Bank, 1990).

11. Based upon DEG's actual expenses and estimates of the optimal level of operating and maintenance costs, World Bank (1987, p 19) estimated that the average incremental cost of water





In summary, due to low tariffs, poor commercial habits and inefficient production, DEG was virtually bankrupt and, consequently, sector infrastructure was crumbling. Further, after several difficult projects, donors were demanding sector reform before granting further assistance. A change of government following the death of President Sekou Touré gave a new opportunity for reform. After several years of discussions with donors, and in the context of a larger structural adjustment

program, the government decided to solicit bids for a private operator to assume responsibility for sector operations.<sup>12</sup>

### 3 Sector Performance and Organization Since Reform

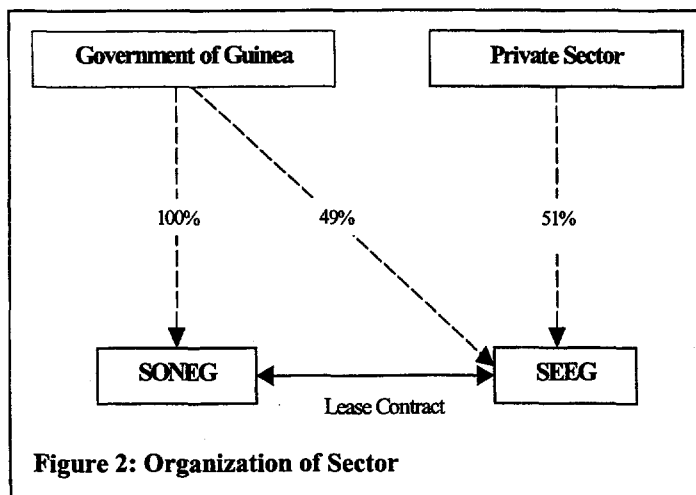
#### 3.1 Sector Organization Following Reform

Upon reform, two enterprises were created: Société d'Exploitation Des Eaux De Guinée (SEEG), the (majority) private-owned operator, and Société Nationale des Eaux de Guinée (SONEG), the state-owned enterprise that manages sector infrastructure. SEEG, which operated under a ten-year lease contract with SONEG, pays SONEG a 'rental fee' for the use of sector assets. **Figure 2** shows sector organization and the pattern of ownership of the two enterprises.

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(AIC) was about US\$0.25/m<sup>3</sup>. However, even this might have been somewhat low, given that in 1989, World Bank (1989, p. 20) estimated that the AIC in Conakry was US\$0.82/m<sup>3</sup>. In practice, these estimates should be treated with caution due both to the large differences in the estimates and to the poor state of DEG's accounts. However, they do indicate that prices would have been too low to cover sector expenses, even if bill collection had been reasonable.

12. See Ménard and Clarke (2000a) for a full discussion of the political economic motivation for reform.



SEEG, which is 49 percent state-owned and 51 percent privately owned, is in charge of the distribution and commercialization of water, including building and maintaining the secondary and tertiary distribution networks (i.e., pipes under 160mm in diameter), metering, billing and collecting. The private owners are two French companies, SAUR (a subsidiary of Groupe

BOUYGUES, a French company mostly involved in public works) and Vivendi (formerly Compagnie Generale des Eaux), a French infrastructure enterprise. All contracts issued in Sub-Saharan Africa to private sector enterprises between 1990 and 1997 in the water sector involved either (at least one of) these companies or Suez Lyonnaise des Eaux, another French infrastructure enterprise (Silva et al., 1998). In addition to the lease contract with SONEG, the two French partners and SEEG signed a management contract, under which the new owners would provide managerial support to SEEG. The management contract specified that the foreign companies were to provide home-office support for day-to-day management, select expatriate staff, and audit procedures. Remuneration was set at 2 percent of SEEG's revenues (World Bank, 1989, p. 9). As their contribution to SEEG, SAUR and CGE provided 51 percent of the initial US \$3 million of capital. For its contribution, the Government donated equipment and infrastructure from DEG and, through SONEG, took responsibility for accumulated sector debt. The private owners are responsible for nominating the General Manager, while the government is responsible for selecting the Chairman of the Board.

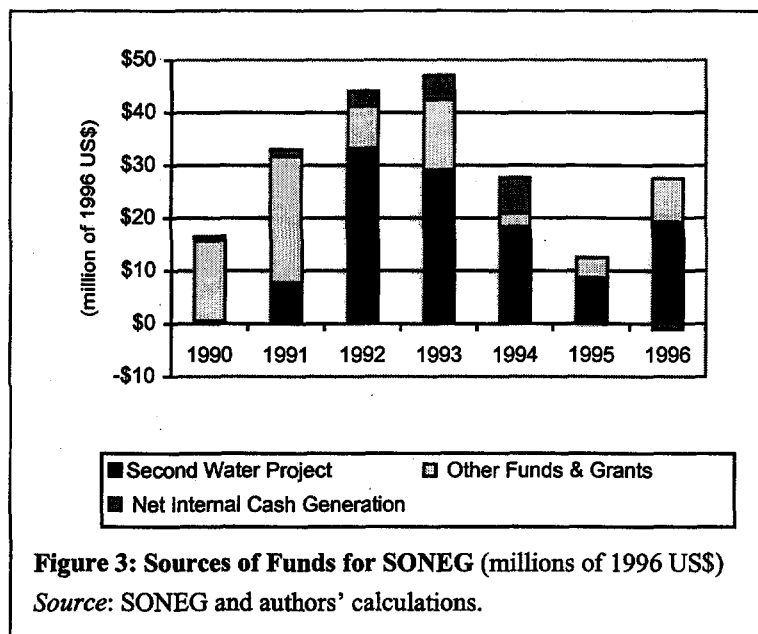
SONEG is a small, entirely state-owned government agency, which reports to a board of directors and the Ministry of Natural Resources and Energy. SONEG owns sector assets and is responsible for investment planning, sector accounting, and servicing sector debt. In theory, the rental fee makes SONEG financially independent of the government (i.e., the rental fee is supposed to cover SONEG's operating costs and allow SONEG to service debt and finance some portion of investment). SONEG is also responsible for financing and supervising most large-scale investment (e.g., reservoirs and transmission pipelines) and for the construction and maintenance of the primary distribution network (i.e., pipes more than 160 mm in diameter).

Conditional on reform taking place, international donors, led by the World Bank, agreed to finance a large investment project. In addition to subsidizing prices during the first

years of reform (see below), the *Second Water Supply Project* had four main investment components.<sup>13</sup>

- i. US \$4 million to support SONEG, including support for technical assistance, consultants, training and equipment.
- ii. US \$4 million to rehabilitate existing facilities.
- iii. US \$1 million to provide consultants' service for studies of secondary centers and to design a training program for staff laid-off from DEG.
- iv. US \$58 million to expand the Conakry water system, including increasing the capacity of the pipeline between Grandes Chutes and Conakry, the addition of a new treatment plant and extension of the distribution network (including 15,000 new connections).

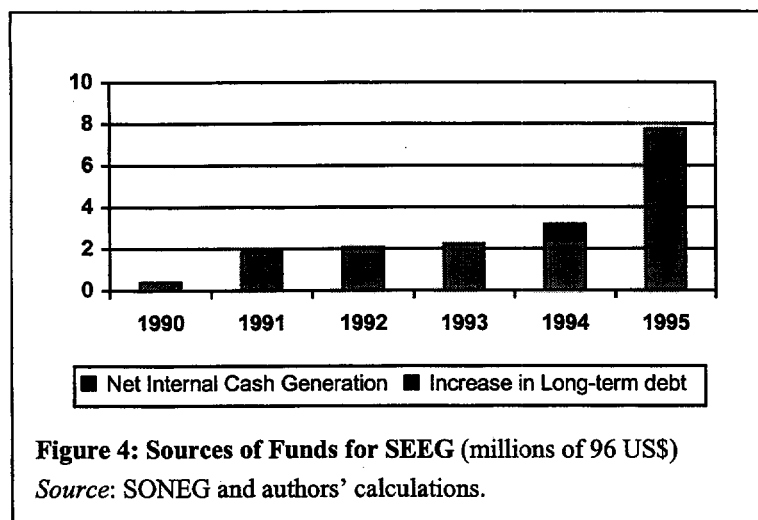
### 3.2 Finance



Since reform, SEEG and SONEG have financed their operations in very different ways. Whereas SONEG obtains most of its funding from donors, SEEG relies heavily on internally generated cash. **Figure 3** shows SONEG's sources of funds. Between 1990 and 1996, over 56 percent of funds came in the form of loans and grants from the Second Water Project (see above). An additional 36 percent of funds were in the form of 'grants and other

funds'. Bilateral donors provide most of the funds in this category, although between 1989 and 1995, we also include the government's contribution to service sector debt. Internal cash generation (i.e., the 'rental fee' paid by SEEG) accounted for only a very small portion of SONEG's funds over this period. The enterprise's high dependence on donor funding is not surprising given that its largest expenditures are related to investment – it will be very difficult to fund investment through the tariff until coverage expands significantly.

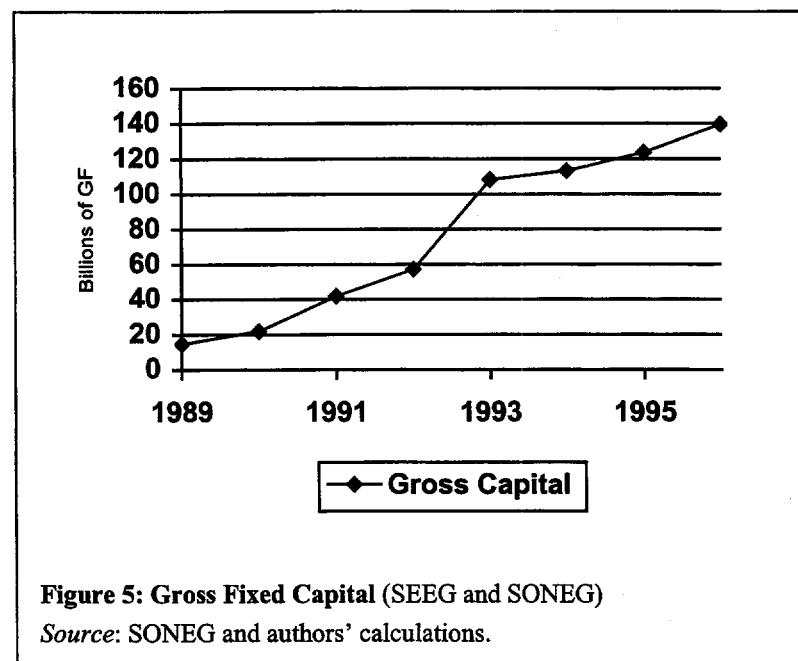
13. Actual expenditures were different from planned expenditures.



In contrast, after the initial equity contribution, SEEG generated almost all of its funds internally – about 95 percent of SEEG's funds since 1990 (see **Figure 4**). Since privatization, neither the government nor the private investors have contributed any additional paid-in capital and SEEG has taken on very little additional long-term debt. Since SONEG accounts for

a greater share of funds than SEEG (compare **Figure 3** and **Figure 4**), total internal cash generation accounted for about 16 percent of sector cash flow between 1990 and 1995.

### 3.3 Fixed Capital Formation

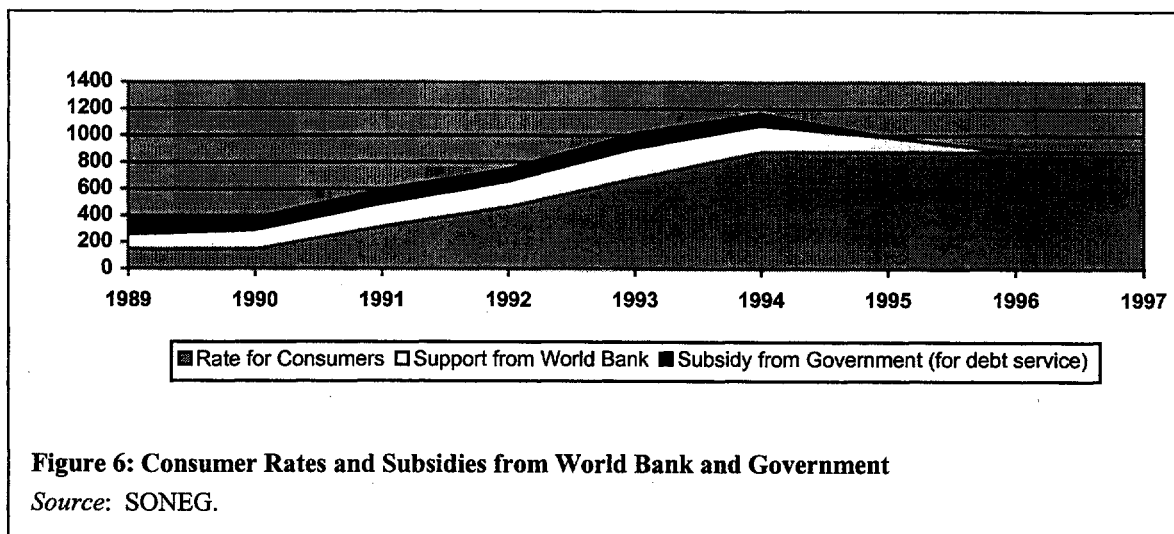


Investment increased after reform (see **Figure 17**). In 1987 and 1988, average annual investment was \$4 million (in 1996 US\$). Between 1990 and 1996, average annual investment increased to about \$19 million (in 1996 US\$). This led to a large increase in gross fixed capital (see **Figure 5**). As noted above, most investment was funded through loans (mainly through the

Second Water project) and bilateral grants from donors. The most significant investments over this period were intended to increase productive capacity in Conakry. These included the construction of an additional treatment plant, an additional pipeline to bring water from Grandes Chutes and two additional storage reservoirs.

### 3.4 Prices

One of the major goals of reform was to make the sector financially self-sufficient within six years (including servicing sector debt, financing some portion of investment and paying a fair return to SONEG and SEEG's capital). Since prices were thought to be below long-run marginal cost, large tariff increases were necessary (Ménard and Clarke, 2000a). Recognizing that this would be difficult to do for political reasons, the government agreed to heavily subsidize prices for six years following reform through the World Bank credit. Consumer tariffs were immediately increased to 150 FG/m<sup>3</sup> in 1989 (about \$0.25/m<sup>3</sup>) to cover all of SEEG's and SONEG's local currency costs (e.g., salaries for local staff). However, the foreign currency costs (e.g., for imported equipment and supplies) were covered by proceeds from the World Bank loan, while the government continued to service part of sector debt.<sup>14</sup> These subsidies slowly declined until 1995, by which time the consumer tariff was supposed to cover all costs (see Figure 6). Prices have been allowed to increase far more quickly than originally planned. By 1996, the average tariff had reached 880 FG/m<sup>3</sup>, compared to an expected price of GNF 660/m<sup>3</sup>.



14. The World Bank contributed US \$16.9 million to subsidize the scheme. The subsidy was described as 'support for the rehabilitation of sector operations' in World Bank documents and was designed as support for the institutional building that was needed to implement the lease contract. The original appraisal was for \$15.4 million, but the final sum ended up being somewhat higher (World Bank, 1998, p. 17).

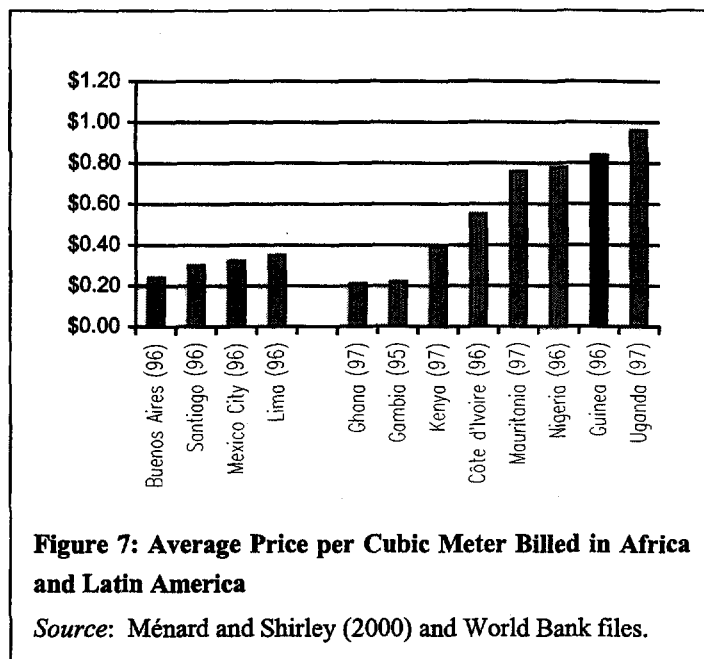
At the end of 1997, the minimum bimonthly payment for service was 13500 FG (about US\$13). This fixed payment included payment for the first 20 cubic meters of water and had to be paid in full whether the household consumed the whole 20 m<sup>3</sup> or not.<sup>15</sup> The price of water between 20 and 60 cubic meters was 850 FG/m<sup>3</sup> and the price above 60 cubic meters was 925 FG/m<sup>3</sup>. In addition, it costs 90,000 FG (about US\$90 in 1996) to be connected to the system.

The most common complaint during field interviews was that the price of water was too high.<sup>16</sup> In general, it is very difficult to compare prices across countries. First, tariff schemes vary greatly across countries – for example, it is hard to compare prices in countries that are fully metered with those where customers pay lump-sum tariffs. Second, the cost of providing water also varies greatly between countries. For example, whereas the water system in Conakry is gravity fed, water in Mexico City has to be pumped from a source that is 140 kilometers away and 1,000 meters below the city. On the other hand, Conakry's system is far smaller and less dense than the systems in the other case studies, increasing costs in Conakry. Finally, water systems are often heavily subsidized (often in non-transparent ways), making comparisons even more difficult. Unlike systems in many other developing countries, Conakry's system provides sufficient revenues to cover operations and maintenance and service sector debt. Finally, since prices are adjusted infrequently and the devaluation rate in many African countries is extremely fast, it often difficult to compare prices in US dollars.

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15. A similar pricing scheme is used in Côte d'Ivoire.

16. Similarly, the organization for consumer protection wrote "living standards in Guinea make it impossible to pay the price charged by SEEG" (World Bank, 1998, p.32)



With these provisos, however, prices in Guinea do appear high, especially when compared to the Latin American case studies (see Figure 7). When compared to other African countries, prices in Guinea remain higher than average, although not completely out-of-line with the other countries (see Figure 7). One final point is that the tariff for low-income consumers in Guinea is high compared to tariffs for similar consumers in other countries. For example, although the average tariff was higher in Uganda than in Guinea (\$0.96 vs. \$0.84), the metered

tariff for domestic users was lower in Uganda than the 'social' tariff for low-income users in Guinea (\$0.57 vs. \$0.64).<sup>17</sup>

### 3.5 Coverage

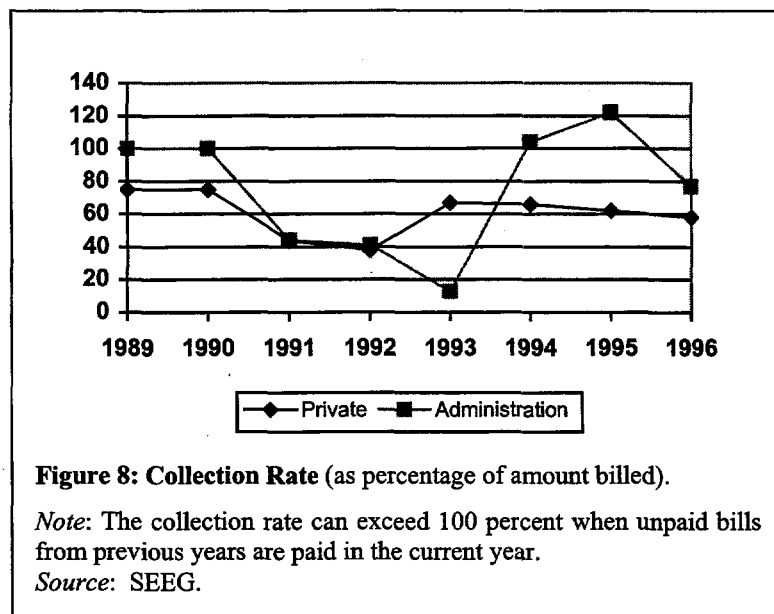
Although the number of (legal) connections increased after the lease was implemented, the increase was slower than anticipated and coverage remains low. Under the Second Water Supply Project, 15,000 new connections were planned (nationwide) by 1995; however, only 11,000 of these connections had actually been implemented by mid-1997. By the end of 1997, there were about 31,000 connections in Guinea, including about 25,000 connections in Conakry (population of about 1.7 million). In comparison, there were close to 180,000 connections for 2.7 million inhabitants in Abidjan, Côte d'Ivoire (SODECI, 1996). Based upon this data, we estimate that less than half the population of Conakry had access to piped water at the end of 1997 (see, Ménard and Clarke, 2000a).

The new pipeline from Grandes Chutes, and the investment in other production facilities, combined with the modest expansion of the distribution network meant that productive capacity far outstripped consumption. Potential water production increased from 54,000 m<sup>3</sup>/day in 1988 to 100,000 m<sup>3</sup>/day by the end of 1993 (World Bank, 1998). In contrast, average daily production was 60,345 m<sup>3</sup>/day in Conakry in 1996, reflecting the

17. Data for Uganda is for 1995 from Dinar and Subramanian (1997).

extremely high rate of UFW – average billed consumption was only 30,255 m<sup>3</sup>/day.<sup>18</sup> If SEEG and SONEG can reduce the rate of UFW to around 20 percent (i.e., the rate in Abidjan), current productive capacity should adequately service needs in the medium-term, even if the number of connections increases significantly. For example, by comparison, average daily water production of 205,000 m<sup>3</sup> provided adequate service for the whole of Abidjan, a much larger city with nearly eight times as many connections as Conakry (SODECI, 1996, p.22).

### 3.6 Billing and Collection



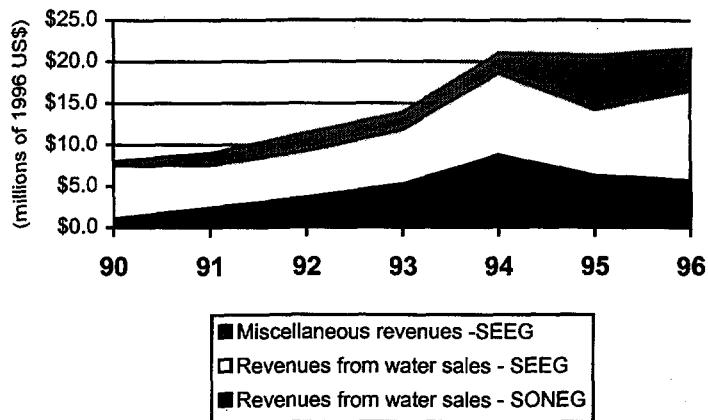
Bill collection from private consumers, which had been very low before reform, improved significantly. However, it remains low compared to other privately operated systems in developing countries (e.g., the private collection rate is 98 percent in Abidjan, Côte d'Ivoire). In 1989 and 1990, 75 percent of the amount billed to private consumers was actually collected. This fell to under 50 percent between 1991

and 1992, before recovering to around 60 percent through 1996 (see **Figure 8**). SEEG is able to, and actually does, cut off water to customers who do not pay their bills for three consecutive months. Field interviews with households, businesses and local administrations confirm that SEEG does this consistently, although its implementation may raise sporadic protests. In addition, the practice of allowing civil servants and deputies to have unbilled connections was ended. For the first two years of the lease, under donor pressure, the government paid its bill regularly (see **Figure 8**). However, in 1991 the government collection rate fell to less than 50 percent, and then dropped further, to close to 10 percent, in 1993.

18. In addition, average daily production and billing do not vary greatly over the year – in 1996, the maximum average daily production and billed consumption for any two-month period was 61,693 m<sup>3</sup> (April-May) and 30,255 m<sup>3</sup> (June-July).



### 3.7 Revenues

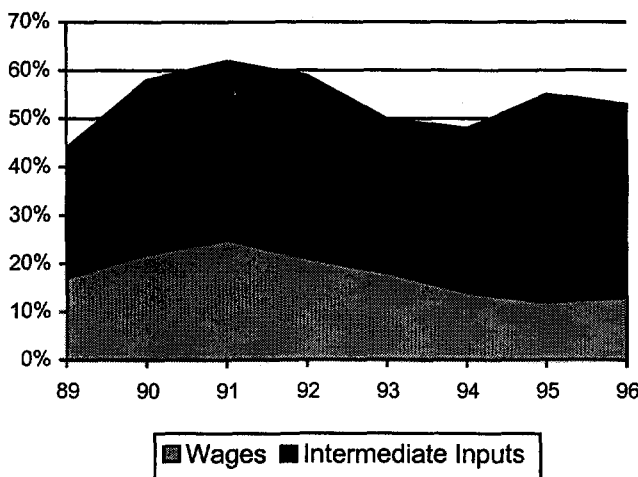


**Figure 9: Revenues for Water Sales and 'Other' (million 1996 US\$)**

*Note:* Revenue from water sales includes connection charges.

*Source:* SONEG.

share of both total revenues and revenues from water sales than SONEG does (about 65 percent of revenues from water sales and about 74 percent of total revenues in 1996). This is not surprising given that SONEG finances most of its activities through grants and loans.



**Figure 10: Wages and Intermediate Inputs (as percentage of revenues)**

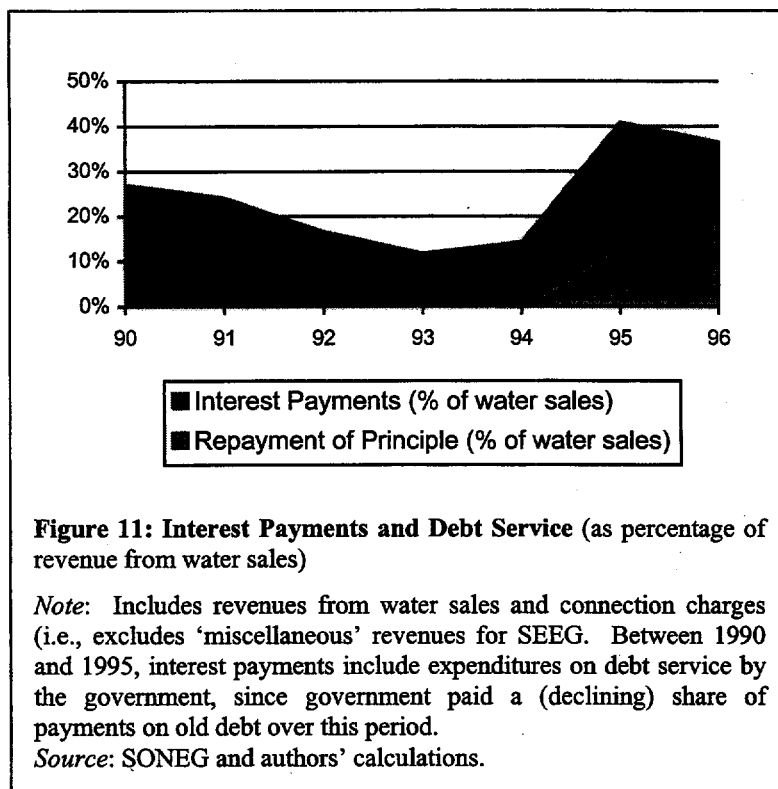
*Note:* Includes wages, intermediate inputs and revenues for both SEEG and SONEG.

*Source:* SONEG.

Total Revenues have increased in real terms quite noticeably since 1990 (see **Figure 9**). Between 1994 and 1996, total revenues from water sales fell, although this was compensated for by an increase in SEEG's 'miscellaneous' revenues. The miscellaneous revenue appears to be from the construction of water-related facilities on behalf of SONEG. SEEG receives a greater

Expenditures on wages and intermediate inputs, for SEEG and SONEG combined, consumed between 48 percent and 62 percent of total revenue between 1989 and 1996 (see **Figure 10**). Since SEEG is far larger than SONEG (500 employees at SEEG compared to 44 at SONEG in 1997), expenditures on wages and intermediate inputs are primarily expenditures by SEEG. In 1996, SEEG accounted for 90 percent of total wage expenditures and 87 percent of expenditures on intermediate inputs. According to field interviews, the salaries for the five

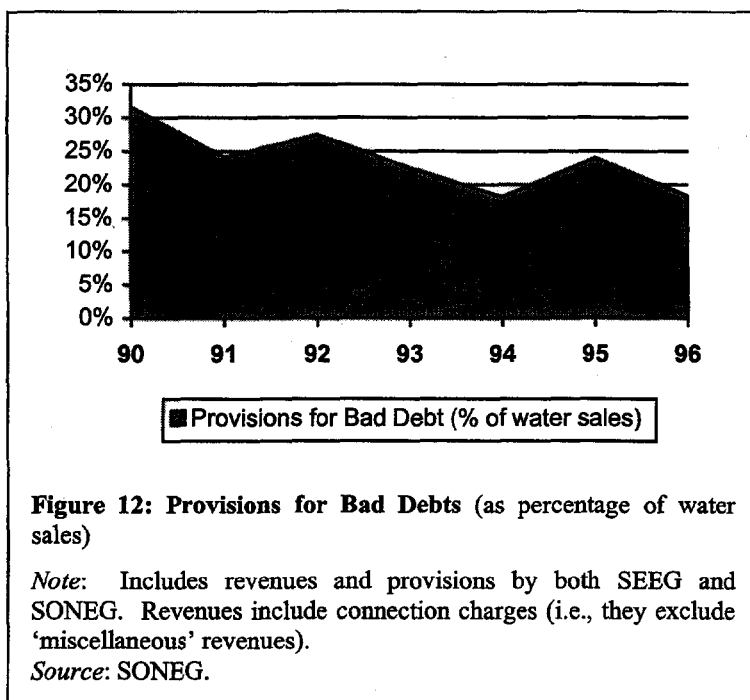
expatriate managers at SEEG accounted for about 15 percent of expenditures on wages and salaries in 1994-1995 (i.e., only about 1.6 percent of total revenues).



By 1996, interest payments and repayment of principle consumed, respectively, about 17 percent and 19 percent of revenues from water sales (see Figure 11). We compare interest payments and the repayment of principle with revenues from water sales, rather than total revenues, because these payments are made by SONEG, which receives revenue only from water sales. Between 1990 and 1996, interest payments of sector debt increased from about \$2.0 to \$2.8 (in 1996 US\$).<sup>19</sup> Since 1996,

principal repayment on many new loans from the Second Water Project has started and new loans have been taken out under the Third Water Supply and Sanitation Project. Consequently, interest payments and principal repayment was projected to increase significantly after 1996 – SONEG projected that interest and principal repayment would increase by 226 percent by 2005. Consequently, without large increases in coverage or prices, the share of revenue consumed by debt service is likely to grow.

19. Note that the estimate for 1990 includes debt service expenditures by the government between 1990 and 1995, since it subsidized debt service payment over this period (see below). Consequently, actual payments by SONEG were considerably lower between 1990 and 1995.



As discussed in the previous section, collection rates, although higher than they were before privatization, have been consistently quite low.

Consequently, provisions for bad debt consume a large portion of revenue.

In 1996, provisioning for bad loans cost SEEG and SONEG about \$3.0 million (in 1996 US\$) – about 18.4 percent of revenue from water sales (see **Figure 12**). In comparison, for SODECI in Côte d'Ivoire provisions for bad debt accounted for only about 2.8 percent of (pre-

tax) revenues. Improving billing, through both improving government payment and making it easier for SEEG to collect from non-paying private customers, would allow SEEG to reduce prices quite substantially.

### 3.8 Unaccounted for Water

As noted above, estimates of unaccounted-for-water (UFW) varied considerably before reform. By 1996, when metering was complete, UFW stood at about 50 percent.<sup>20</sup> Although it is difficult to say whether UFW has improved, it remains high compared to either international standards (between 10 and 20 percent) or to other water systems in West Africa.

Several factors contribute to the high rate of UFW in Guinea. First, although it is very difficult to estimate the number of illegal connections accurately, they appear to be a large problem, especially in sections of the city where the old pipes are buried only a few inches underground. This makes it easy to connect to the system illegally – it also means that the pipes are easily broken (e.g., by heavy vehicles). A related problem, especially in the older part of the city, is that overlapping lots and interlaced households make it very difficult to interrupt water supply and to control connections. In addition to the direct theft of water, leakage from poorly maintained illegal connections contributes to the UFW

20. Ninety-five percent of connections were metered by 1996 and, therefore, it is easier to estimate UFW accurately.

problem. Further, officials from SEEG note that it is very difficult, in the existing institutional environment, to prosecute persons with illegal connections and, therefore, there is little the company can do to deter this behavior.

Although theft plays a role, poor maintenance and ancient infrastructure also contributes to the problem. However, there might be little reason to devote significant resources to reducing UFW due to leakage. As we have shown, potential production outstrips both consumption and actual production. Consequently, SEEG can continue to increase the number of connections without reducing UFW. Further, since the system is gravity-fed, the marginal cost of a cubic meter of water is low – essentially the cost of treatment. Although SEEG's accounts are not detailed enough to estimate the marginal cost per cubic meter, most costs (e.g., provisioning for bad debt, debt service and salaries) would not appear to depend heavily upon quantity of water provided. For this reason, it might not be economically desirable to devote a large amount of resources to reducing UFW. Although with hindsight it might be argued that the productive capacity added under the Second Water Project could have been delayed if UFW had been reduced instead, this was not clear at the time the project was proposed. UFW was thought to be considerably lower before metering was complete and, therefore, consumption was thought to be close to productive capacity.<sup>21</sup>

Although the reason that SEEG has not reduced UFW is that SEEG pays the rental fee to SONEG based on bills collected, not on water produced or delivered by SONEG. Therefore, since SEEG does not pay for raw water and does not lose sales due to UFW, it has little incentive to spend money to reduce it. One possible reform that might encourage SEEG to reduce UFW would be to make SEEG pay SONEG the (estimated) marginal cost of water for water delivered to SEEG in addition to the full rental fee for bills collected. Although this would increase SEEG's costs, if the money were paid to SONEG it would not have any effect on sector costs and, therefore, tariffs would not have to be increased. That is, the 'rental fee' per cubic meter of water collected could be reduced, leaving SONEG's total revenues unchanged.

### **3.9 Water and Service Quality**

Although it is difficult to find exact data, there is almost universal agreement that the quality of piped water improved significantly after reform. Before reform, water was often

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21. Before reform, productive capacity was about 54,000 m<sup>3</sup>/day (World Bank, 1989). In 1996, by which time metering was complete, billed consumption was only about 30,255 m<sup>3</sup>/day. This would leave some space for UFW and for seasonal variation in consumption (which is quite low in Guinea) without increasing productive capacity. However, because the estimate of UFW was too low, it was unclear at the time of reform that actual consumption was that low. Further, it was hoped that the number of connections would grow faster than they actually did.

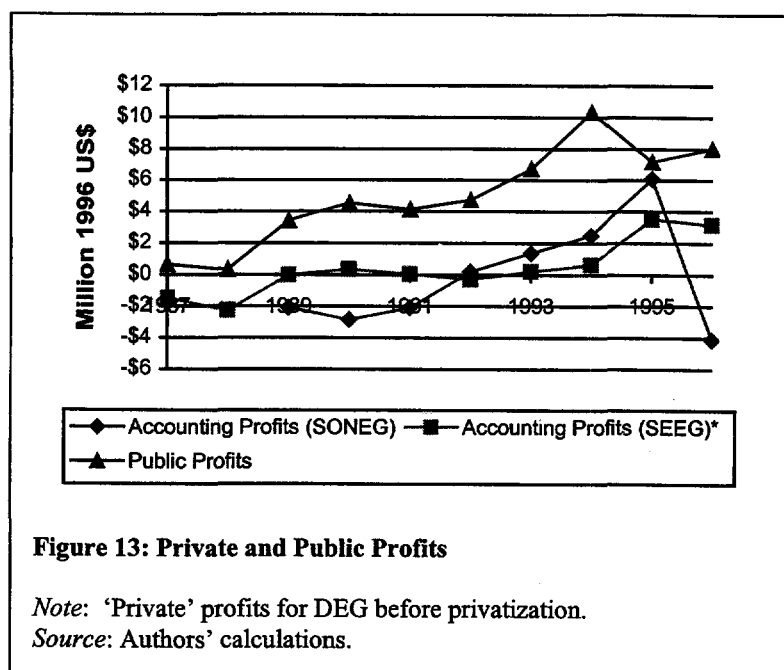
visibly polluted and was not safe for human consumption. For example, the manager at the local *Coca-Cola* bottling plant noted that while the water was muddy and discolored for several years after reform, regular tests confirm that it now meets the standards imposed by their international headquarters. The *Organization for Consumer Protection* in Conakry rates water quality as excellent and notes that it can be consumed as delivered (World Bank, 1998, p.31). Similarly, a 1994 study, which measured chemical and bacteriological contamination in piped and well water in Conakry, concluded that piped water “was found to comply with WHO norms for drinking water” (Gélinas et al., 1996, p. 2017).

As noted above, however, water-related health problems remain a major issue due to the large number of customers who consume unsafe water from contaminated wells. These difficulties are confirmed by data on sickness traditionally related to unsafe water and inadequate sewerage, particularly those of group 1, which remain the main source of mortality (in decreasing order: malaria, diarrhea, hepatitis A, poliomyelitis, and skin diseases). Gélinas et al. (1996) suggest that the use of piped water, rather than well water, would reduce the incidence of water-borne diseases (p. 2017).

The reform has also had a positive impact on customer service. Delays for connecting new customers are reasonable, although many consumers complain about SEEG’s conservative policy of bundling customers before connecting them (i.e., waiting until a large group of consumers pay deposits before expanding the network). Similarly, although there are some complaints about delays getting repairs done, there is general agreement that this is not a major problem.

### **3.10 Profits and Profitability**

Before reform, DEG was losing large amounts of money. Following privatization, SEEG’s operating profits were close to zero until 1993 when they started to increase. By 1996, they reached GF 6.8 billion (\$6.8 million in 1996 dollars). The increase in SEEG’s profits after 1993 coincided with a decrease in the ‘rental fee’ that SEEG paid to SONEG. Although the average consumer rate remained at GF 880 between 1994 and 1996, the share of the tariff that SEEG paid to SONEG fell from GF 527 in 1994 to GF 370 in 1996. One constant drain on SEEG’s accounting profits has been the large charges that it has taken for unpaid bills. Between 1989 and 1996, provisions for bad debts were close to 20 percent of operating revenues (**Figure 12**).



In 1989-90, SONEG lost about \$2.8 million (Figure 13). However, profits slowly improved through 1995, reaching \$6.1 million that year. In 1996, SONEG's operating profit became negative (-\$4.1 million) once more. The decline appears to be due to the sharp drop in the 'rental fee' that SEEG paid to SONEG and the end of the subsidy that the government paid SONEG for debt service (GF 88/m<sup>3</sup> in 1994). Although SONEG appeared profitable in 1995, this appears to be due to a

large one-time increase in non-operating income (from GF 396,000 in 1994 to GF 9.6 billion in 1995). Without this, SONEG would have also lost money in 1995 – close to \$3.7 million.

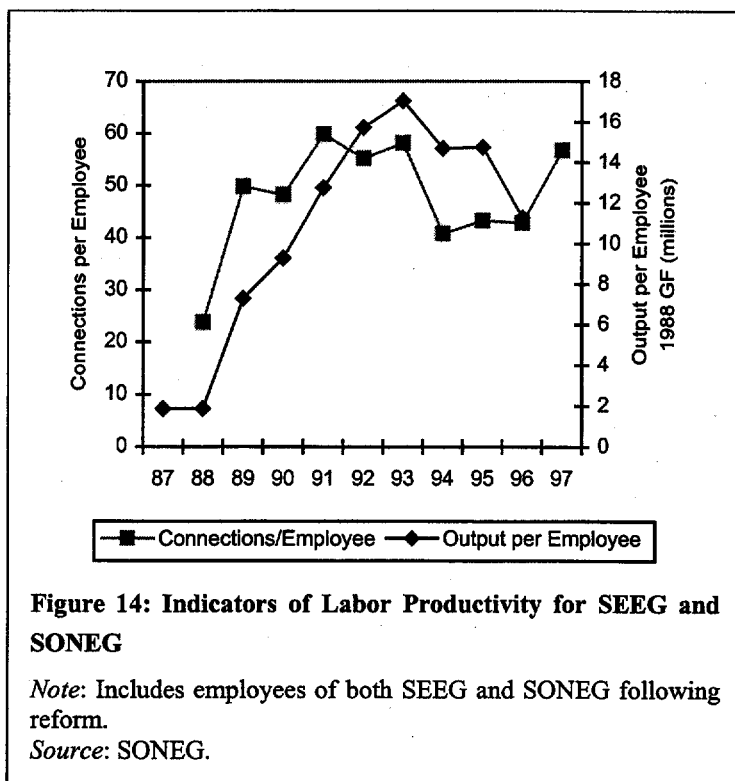
Figure 13 also shows 'public' profits over the period since reform. Public profits include returns to debt-holders (i.e., interest payments), to the government (i.e., net taxes), depreciation and deducts the opportunity cost of working capital (both SEEG's and SONEG's).<sup>22</sup> This measure was a little greater than zero under public ownership. Following privatization, it increased significantly in real terms, remaining positive through the entire period.

### 3.11 Productivity

Figure 14 shows two partial productivity indicators for labor – connections per workers and output per worker. Both indicate an immediate improvement upon the signing of the lease contract. This was primarily due to the large reduction in the number of workers which immediately followed reform. DEG employed about 504 workers before reform, while after reform SEEG and SONEG had only 312 and 43 employees respectively. After this immediate increase, connections per employees failed to increase significantly and actually dropped between 1994 and 1996. The increase in 1997 was due

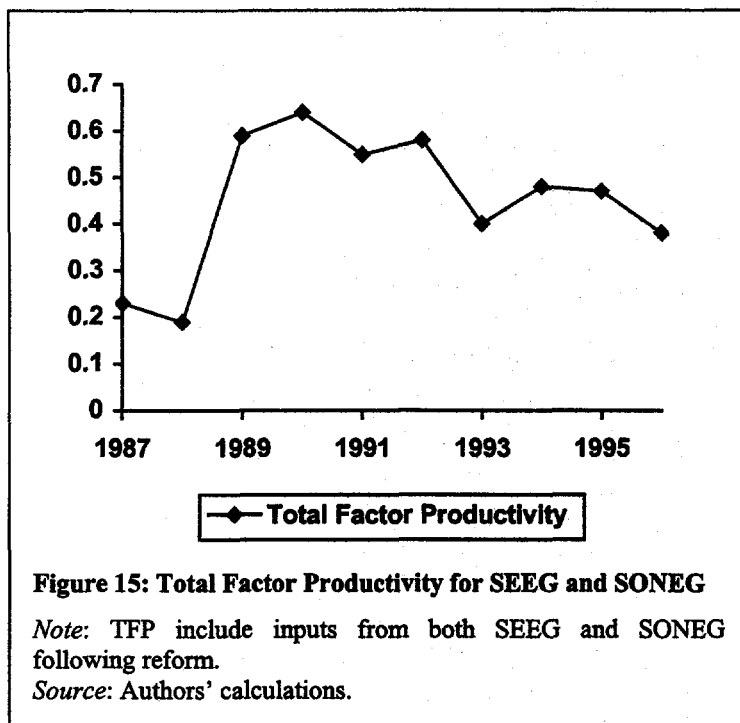
22. Depreciation is included to avoid the use of accountants' rates. See Galal et al. (1994) and Jones et al. (1990) for a full description.

to a large increase in the number of connections that year (23,435 in 1996 compared to about 31,000 in 1997).



employee continued to increase, even as connections per employee stagnated.

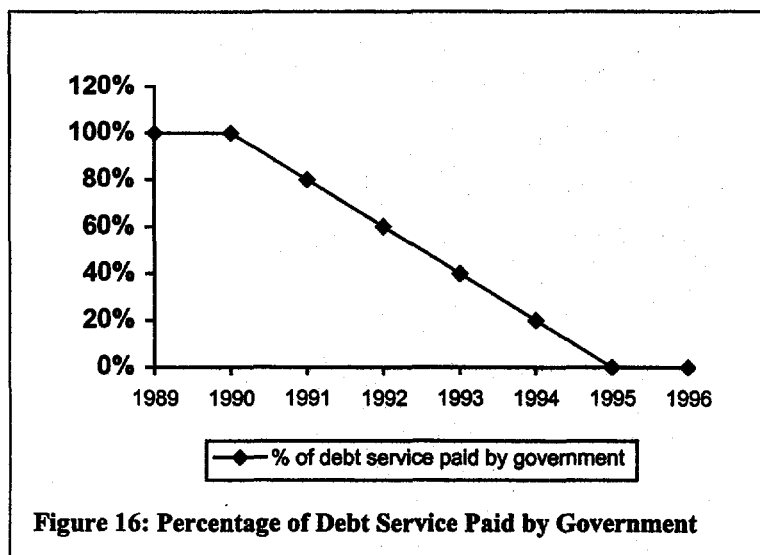
The second measure of productivity is real output per employee. Although this measure also increased immediately following reform (due to the large reduction in labor force), it continued to grow after this. The difference in the two indicators is probably primarily due to the large increase in 'miscellaneous' revenues (see **Figure 9**). Although water sales increased relatively slowly following reform, revenues from construction and other works related to the water sector increased more quickly. Consequently, output per



The final measure of productivity is total factor productivity (TFP), which also increased at the time of reform. However, since this time, TFP has also slowly declined (although remaining considerably higher than it was before reform). The most noticeable decline was the large drop in 1993. This was mainly due to the large increase in fixed capital (see Figure 5) due to investment in production facilities. Since a large part of productive capacity remained unused by the end of 1996, due to the slow development

of the distribution network, total factor productivity should increase as the distribution network expands.

### 3.12 Fiscal Effects



Before reform, the government had been heavily subsidizing DEG by paying a large fixed sum for water and paying an additional subsidy by servicing sector debt. The total subsidy that the government provided to DEG was about \$3.1 million (in 1996 US\$) in 1987 and 1988 (see Figure 19). As part of a transitional agreement, the government agreed to provide a



amount did not fall significantly until 1994 when the subsidies were ended (see Figure 19). It appears that the reason that the payment did not fall, although the government was paying a smaller share, was that debt service increased due to borrowing associated with the second water project.

Even after the subsidy provided from the government's budget, it was thought that it would be politically difficult to immediately increase prices enough to cover operating expenses and to provide a fair return on capital. Consequently, as noted above the World Bank provided a loan that was used to subsidize a declining portion of costs. Since this money was provided through a loan guaranteed by the government, we treat this as a government subsidy (to SEEG) in the cost-benefit analysis below. Although this might be an appropriate way to handle this loan, there are arguments against treating it in this way. First, the loan is entered onto SONEG's balance sheet as a liability and, therefore, will presumably be serviced through higher tariffs (rather than from government revenue). In this respect, the subsidy is more like a cross-subsidy from future consumers (who will have to pay interest and repay principal through higher tariffs) to current consumers (who benefit from lower tariffs immediately). However, in practice, since the cost-benefit analysis only extends through 1999, the cost to future consumers is largely omitted.<sup>23</sup> For this reason, we conservatively treat this as a direct subsidy.<sup>24</sup> This has the effect of increasing the cost of reform to government (i.e., it decreases the government's gain from reform).

#### **4 The Cost-Benefit Analysis**

In this section of the paper, we describe how we implemented the cost-benefit analysis proposed by Galal et al. (1994) and Jones et al. (1990). One problem that we had throughout the analysis was the poor quality of data available before reform. This makes it difficult to specify the counterfactual. An additional problem is that it is difficult to account for performance and quality improvements since DEG did not produce data on many aspects of its own performance. To address these problems, we make conservative assumptions, described below, that will tend to lead to us to underestimate the benefits of reform. For this reason, the estimated welfare impact should probably be seen as a lower bound on the actual benefit of reform.

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23. The IDA loan used to subsidize the tariffs had a grace period of six years and a 40-year maturity.

24. In addition, SONEG entered a matching asset 'foreign management support' on its balance sheet to offset the liability. When calculating the residual value of SONEG, we subtract this asset from SONEG's residual value since it would not have any value to a potential investor. Once again, the main effect of this action is to lower the government's gain from reform (i.e., if we treated it as having residual value the government would gain significantly more from reform.

A final practical problem when performing the cost-benefit analysis is that the analysis described in Galal et al. (1994) was designed for analyzing the privatization of a single company. In this case, DEG was broken into a private company that is responsible for operations and maintenance and a public company that is responsible for investment. Although SONEG keeps detailed sector accounts, using these accounts would be misleading because this would assign any profits or losses made by SONEG to SEEG's shareholders. However, to correctly calculate consumer surplus, we need to account for the part of the tariff that is paid to SONEG and to assess the fiscal effect of reform on the government we need to account for SONEG's performance. In practice, what we did was to include SONEG's revenues as revenues for SEEG and then subtract SONEG's costs, expenses and profits.<sup>25</sup> This allows us to calculate productivity based upon the performance of both SEEG and SONEG, while not attributing SONEG's profit or loss to SEEG's shareholders. In summary, amounts paid to SONEG do not affect the welfare of SEEG's shareholders, but do affect the price and, therefore, the welfare of consumers.

#### **4.1 Revenue and Demand Breakdown**

Revenue is broken into four separate categories: water supplied to private consumers, water supplied to the government, connection fees and miscellaneous. Before 1989, 'miscellaneous' revenue is described as 'works invoiced' in DEG's accounts, while after 1989, it includes revenue from all sources except water supply and connection charges. Most 'miscellaneous' revenue after reform is probably from construction of water infrastructure performed by SEEG on behalf of SONEG.<sup>26</sup> Unlike in the Latin American cases, neither SEEG nor DEG was responsible for providing sewerage service. Therefore, we do not analyze the effect of reform on sewerage.<sup>27</sup>

Although, under ideal circumstances, we would like a finer breakdown of revenue (and demand), this is impossible because neither revenue nor volume billed was broken

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25. We also subtract SONEG's 'profits'.

26. However, as noted in Ménard and Clarke (2000a), SEEG has provided neither SONEG nor the authors of this study with a detailed breakdown of this category and so it might include revenues from other sources as well as revenues from construction.

27. There are several additional reasons for omitting sewerage. First, this is a partial equilibrium analysis and, therefore, we omit the effect that reform has on other subsectors. Second, reform of urban water did not have a direct effect on this sub-sector and, therefore, we might expect little difference between the actual and counter-factual scenarios concerning sewerage. Finally, there is very little information on the performance of this subsector, making analysis difficult. For example, we do not have accurate estimates of the number of customers, let alone sector accounts for sewerage.

down further. For example, private consumption was not broken down into residential and non-residential consumption and neither government nor private consumption was broken down into metered and unmetered consumption. The breakdown into government/non-government is, however, useful. In both of the African case studies, government consumption accounts for a significant portion of the companies' revenues. Under the actual scenario, the Guinean government accounted for 56 percent of total revenue in 1989, falling to 29 percent in 1997. In the counterfactual scenario, government consumption is even more important. Due to the overestimate of government consumption, revenue from the government accounted for close to two-thirds of total (billed) consumption in 1988.<sup>28</sup>

For the analysis, we use cubic meters of water as the quantity variable. In general, this is the most intuitive measure to use for the cost-benefit analysis. Unfortunately, we have to use the average price for water, rather than the marginal price. Although the marginal price is the economic concept that we are interested in, we do not have sufficient data to use it in the analysis. Several of the other cost-benefit analyses in this study use the same approximation (e.g., Alcazar, Abdala, and Zuluaga, 1999). Using the average price, rather than the marginal price, for metered consumers should not have a large effect on results since the marginal price schedule is relatively flat and, therefore, the average price is close to the marginal price. For example, the average price was GF 880/m<sup>3</sup> in 1996, while the marginal price varied between GF 680/m<sup>3</sup> and GF 925/m<sup>3</sup>. It is more troubling for unmetered consumption, since the amount that was billed was based upon 'estimated' consumption. However, in the absence of improved data, we do not have any better way of handling this.

A second problem with cubic meters of water is that, especially in Guinea where the data is very poor, it is difficult to estimate cubic meters consumed when water consumption is not metered. Although, metering was virtually complete by 1995, only 11 percent of connections were metered before reform. Since estimates of unaccounted-for-water (UFW) varied widely, it is unclear what actual consumption was.<sup>29</sup> The estimates of water consumed for the years immediately following reform reflected a relatively low estimate of UFW. However, as we argue below, this was likely to be optimistic and, therefore, we attempt to partially correct for this in the analysis.

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28. Since reform, the breakdown of reported revenue is slightly lower than total reported revenue from water sales. However, the difference is not large (on average, the breakdown is 8 percent lower than total revenue). We distribute the missing revenue between the two categories based upon the shares reported for that year.

29. According to the 1985 audit report, UFW was at least 60 percent in 1983. However, one year later, the World Bank (1987) estimated, more optimistically, that UFW was 39 percent and, in 1989, World Bank (1989) estimated that UFW was about 35 percent.

#### 4.1.1 *Private Water*

The main category of demand is private (i.e., non-government) water consumption. To compute consumer surplus, we need to know how much excess demand there was and the price elasticity of demand. Since good estimates are not available for Guinea, we instead assume parameter values based upon parameter estimates from other countries and upon the information available in Guinea itself. In the Section 5, we assume alternate values to test the sensitivity of results to these assumptions. Prior to reform, there was significant excess demand for piped water. However, as the number of connections and the price of water increased (making connections less attractive to consumers), excess demand fell. We assume that at 1998 prices, there was no excess demand. This seems reasonable, given that only 10 percent of Conakry residents indicated they would be willing to pay the cost of a service connection and most said they would not be willing to pay the average consumer tariff (World Bank, 1997). We used this, along with an assumed demand elasticity, to calculate the slope and q-intercept parameters for 1998. In the other years, we simply shift this demand curve by population growth (see Shirley, Xu and Zuluaga, 1999). As in Shirley, Xu and Zuluaga (1999), demand was assumed to be identical in the actual and counterfactual scenarios (i.e., reform did not affect demand at any given price).<sup>30</sup>

Unfortunately, to our knowledge, no estimate of the price elasticity of demand is available for urban consumers in Guinea. Abdala (1997) and World Bank (1996), which summarize results from other studies, report a range of price elasticities in developing countries, with most between  $-0.2$  and  $-0.6$ . However, only one of the reported elasticities is for an African country – a 1977 study that found a price elasticity of  $-0.58$  for urban consumers in Kenya. Further, since the elasticities from these studies are presumably for consumers who already have connections, they might not be appropriate for Guinea where much of the change in demand was presumably due to new customers' decisions to connect. The World Bank Water Demand Research Team (1993, p.54) reports that their estimates of elasticities for willingness to connect to an improved source of water with respect to the average monthly bill were surprisingly large.<sup>31</sup> They estimate elasticities of  $-0.7$  and  $-0.4$  for willingness to use public taps in Zimbabwe and Kenya and elasticities of  $-1.5$ ,  $-0.7$  and  $-0.7$  for willingness to use private connections in India, Brazil and Pakistan. Although it is not clear whether these estimates, which were for rural areas, are appropriate

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30. In particular, this is likely to underestimate the true effect of reform, since reform dramatically improved water quality, which is likely to shift demand outwards.

31. The elasticity of demand for improved sources with respect to the average monthly tariff is defined as the percentage change in the probability of using the improved source as a result of a 1 percent increase in average monthly bill.

for urban customers, the experience with reform in Guinea suggests that the elasticity for willingness to connect might also be large.<sup>32</sup> For this reason, we use a high estimate of the price elasticity of demand (-0.6). In the sensitivity analysis, we present results assuming different price elasticities (see Section 5.2).

#### 4.1.2 *Administration Water*

In 1990, before any government agencies were metered, government consumption was estimated to be 7.5 million m<sup>3</sup>/year. However, once metering was complete it became clear that this substantially overestimated actual government consumption (World Bank, 1998).<sup>33</sup> For this reason, we use the 1991 estimate of government consumption for 1989 and 1990, since nearly half of government consumption was metered by then. This assumption makes the 1989 and 1990 estimates of UFW more plausible (51 percent and 49 percent rather than 35 percent and 31 percent), given the large amount of UFW after metering was complete.

In addition to assuming a price elasticity of demand for private consumption, we also need an estimate of the price elasticity of demand for government consumption. There is very little guidance in the literature regarding this parameter. The central government did take several steps to reduce government consumption once metering was complete, with government consumption dropping 25 percent between 1995 and 1996, suggesting that the elasticity is not zero. In general, past research has suggested that elasticities for non-residential service are higher than for residential service (Abdala, 1997; World Bank, 1996). However, it is not clear that these estimates, which are usually for industrial firms, are appropriate for government administration. For this reason, we use the same elasticity estimate for government consumption as for private consumption. In practice, the difference in government consumer surplus between the actual and counterfactual scenarios is not greatly affected by changing the elasticity (see Section 5.2).

#### 4.1.3 *Connection Fees*

A small part of SEEG's revenues comes from connection fees. According to World Bank (1997), the average cost per connection was about 300,000 GNF (about \$299

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32. In 1994, Brook Cowen (1996) reports that nearly 12,000 connections were inactive due to non-payment in Guinea (compared to about 20,000 active connections). Further, World Bank (1998, p. 5) reports that consumers refusing to re-connect after being disconnected from the system for non-payment continued to be a problem after 1995. This suggests that the availability of well water in Conakry might make the elasticity of water demand higher than in other cities.

33. In 1995, when metering was complete, government consumption was measured to be 4.7 million m<sup>3</sup>/year.

in 1996), while the average cost to consumers was about 90,000 GNF (about \$90 in 1996). Following Galal et al. (1994), we subtract connections fees from consumer surplus for (private) water consumption.<sup>34</sup> The implicit assumption is that consumers get utility from the water that comes from the connection, not from the connection itself. Hence, potential consumers compare the net present value of their consumer surplus from usage with the present value of the connection fee and the stream of tariffs. Consequently, the cost of the access fee needs to be subtracted from aggregate consumer surplus.

#### *4.1.4 Miscellaneous*

The final category is listed as 'miscellaneous'. After reform, it seems that most revenue in this category is revenue that SEEG receives for construction contracted to SEEG by SONEG. Between 1989 and 1996, this accounted for 22 percent of SEEG's revenue, with its contribution increasing over time. Consumer surplus is not calculated for this sector. If SEEG and SONEG were a single company, then the company would not receive any revenue from 'construction' (other than for the connection fee) and, therefore, this would not appear as separate source of revenue. Rather, the cost of construction (i.e., in terms of intermediate inputs and labor) would appear as expenditures on the profit and loss statement. Therefore, we would not compute a consumer surplus in this market in this partial equilibrium analysis. For comparability with the counterfactual, therefore, we do not calculate consumer surplus for 'miscellaneous'. This is also appropriate because we are primarily interested in the direct effect of increased access to water.<sup>35</sup>

## **4.2 Counterfactual Scenario**

In this section of the paper, we describe the main differences between the actual and counterfactual scenarios. In general, specifying a counterfactual scenario is difficult since it requires considerable detail on something that has not occurred. In this case, DEG's poor accounting and data collection standards make it even harder, since the

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34. Since it appears that most new connections were private and we do not have a breakdown of access fees in government and private, this seems the most appropriate way to handle this charge. In practice, this is not likely to have a large effect on results for either the government or private consumers since connection fees are, in general, quite small. Of course, it does not matter for total (i.e., government + private consumer surplus) consumer surplus whether we subtract it from government or private consumer surplus.

35. In addition, since this is a 'catch-all' category, it would be difficult to make assumptions regarding excess demand and price elasticity of demand.

counterfactual relies heavily upon information from the pre-reform period.<sup>36</sup> One solution might be to base the counterfactual on the performance of the private utility in its first year of operation (i.e., to assume that the public utility would have operated as efficiently as the private company at that time). However, this would severely underestimate the gains from reform, since many of the positive changes appear to have occurred very quickly. For example, improvements in productivity (see Figure 14 and Figure 15), in billing and collection, and the regularization of unregistered connections were all accomplished quickly. Therefore, we are forced to rely upon DEG's unaudited accounts. In practice, this is likely to underestimate the benefits of reform since the published accounts probably overstate DEG's success by not recording arrears to workers and suppliers correctly and by not provisioning for unpaid bills sufficiently.

In addition to concerns about DEG's accounts, many other aspects of DEG's performance are difficult to quantify due to unsatisfactory and inconsistent data. In particular, it is extremely difficult to quantify service and water quality improvements associated with the reform. As noted earlier, service was intermittent before reform and the water was not potable. However, since DEG did not keep accurate records of any measures of service performance (e.g., hours of interrupted service or number of leaks pending repairs) or water quality (e.g., compliance with WHO standards), it is impossible to quantify this. Therefore, since any attempt to include quality improvements in the analysis would be speculative, we simply omit them from the cost-benefit analysis.<sup>37</sup> Again, this is a conservative way of dealing with the problem since it will underestimate the gains to consumers from reform. Recognizing this, the estimated welfare gain to consumers might be seen as a lower bound on the actual gain.

#### *4.2.1 Investment and Output Growth*

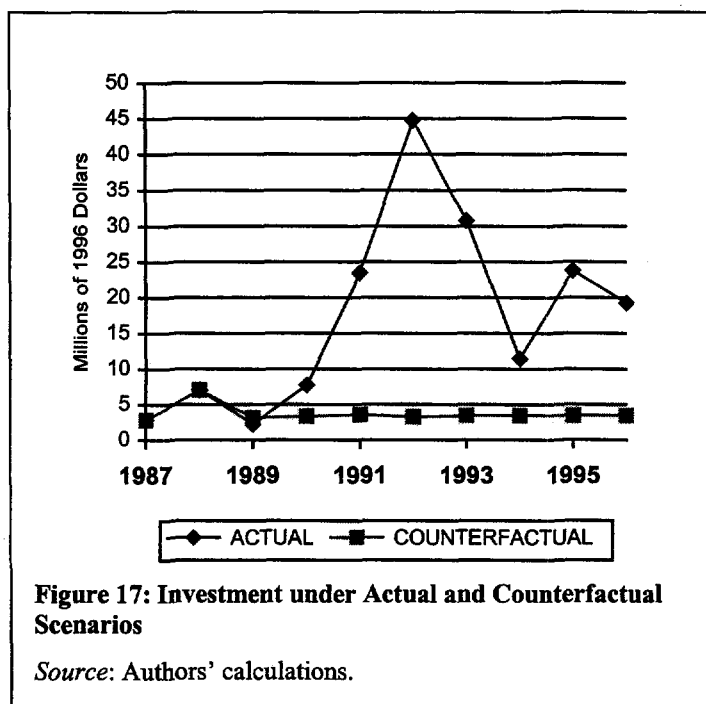
One of the differences between the actual and counterfactual scenarios is that we assume that the World Bank would not have approved funding for the Second Water

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36. World Bank (1989, p.10) notes that DEG's accounting procedures differed from international standards, that the accounts were unaudited between 1986 and 1988 and that although DEG's accounts were audited between 1979 and 1985, they could not be certified. The poor quality of DEG's accounts was noted in the 1985 consultants' report, which concluded that because of DEG's poor accounting practices, the non-availability of most relevant data, and because DEG's budget was spread between several different ministries, it was impossible to even perform an audit.

37. Further, as noted in Galal et al. (1994, p. 27), since we are interested in the difference in consumer surplus between the actual and counterfactual scenarios, the assumption of linear demand is relatively innocuous. This is because the area close to the vertical axis will be cancelled out. However, if we assume that quality improvements move the demand curve the area close to the vertical axis would no longer cancel out.

Supply Project without the government introducing some degree of private sector participation. This is supported by World Bank documents and discussions with World Bank staff involved in the project.<sup>38</sup> Since investment in the actual scenario was mainly supported through donor's funds (see Figure 3), one of the main assumptions is that DEG would only perform sufficient investment to maintain assets (i.e., that investment would be equal to real depreciation). This assumption sets real investment at about the observed level in 1987, which is slightly lower than observed investment in 1988. Consequently, under the counterfactual scenario, there is no output growth.



This is consistent with two observations. First, since average daily production in Conakry was about 45,000m<sup>3</sup>/day and maximum average production was estimated to be 54,000m<sup>3</sup>, it appears that little system expansion would be possible in Conakry without upgrading productive capacity.<sup>39</sup> However, the expansion of the pipeline from Grandes Chutes and the additional treatment capacity that would be required would not have been possible at the observed level of investment in the late 1980s.<sup>40</sup> Second,

38. For example, World Bank (1987, p. vi) concludes, "DEG as presently constituted is not competent to be responsible, either for project implementation or for system operation and maintenance." Although, as pointed out by World Bank staff involved in project design, it is possible that a different type of contract (possibly with donor support) would have been implemented at a later date, it is very difficult to model the effect that this would have sector operations.

39. Pre-reform data is for 1984 – the last year before reform that reliable data is available (World Bank, 1987, p. 38). Maximum production capacity was 60,000m<sup>3</sup>/day, but this could not be maintained as an average level of production (World Bank, 1989, p. 45).

40. World Bank (1989) reports that the estimated cost of the transmission pipes from Grandes Chutes to Conakry and the additional treatment plant to treat the water was US\$38.8 million (of US\$57.9 million in total investments in Conakry). However, actual costs were probably higher



although data quality makes it very difficult to assess the rate of system expansion after the end of the First Conakry Water Supply Project in the mid-1980s, the assumption of no expansion seems consistent with DEG's observed performance. Between 1984 and 1989, it appears that most measures of performance were deteriorating. For example, the number of registered connections in Conakry fell from 11,167 in 1984 to about 10,200 in 1988 and the number of active standpipes fell from 112 to about 40.<sup>41</sup> Over the same period estimated (national) consumption fell from 12.83 million m<sup>3</sup>/year to 10.89 million m<sup>3</sup>/year.<sup>42</sup> Although estimated production increased slightly from 17.5 to 18.9 million m<sup>3</sup>/year, this could reflect increased UFW, due to poor maintenance rather than increased consumption. In summary, there is little evidence of any significant expansion between 1984 and 1989. Since assumed investment under the counterfactual is lower than the observed average investment in 1987 and 1988, the assumption of no expansion seems reasonable.<sup>43</sup>

#### 4.2.2 *Productivity*

As noted above, both labor and total factor productivity improved significantly following reform (see Figure 14 and Figure 15). However, after this initial improvement, both measures of productivity appear to have declined slightly through 1996. In the cost-benefit analysis, we assume that the improved productivity was a result of reform. This seems to be a reasonable assumption, since there is little evidence of increased productivity before reform. As noted above, most performance measures were falling or holding steady and the number of staff was relatively constant (504 in 1984 and about 500 in 1988).<sup>44</sup> Hence in the counterfactual scenario, we assume that there would be no significant productivity gains.

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since total expenditures on planned investments in Conakry were US\$84.9 million (rather than US\$57.9 million). Total investment by DEG averaged \$4.7 million in 1987 and 1988 and much of this would be required for maintenance etc.

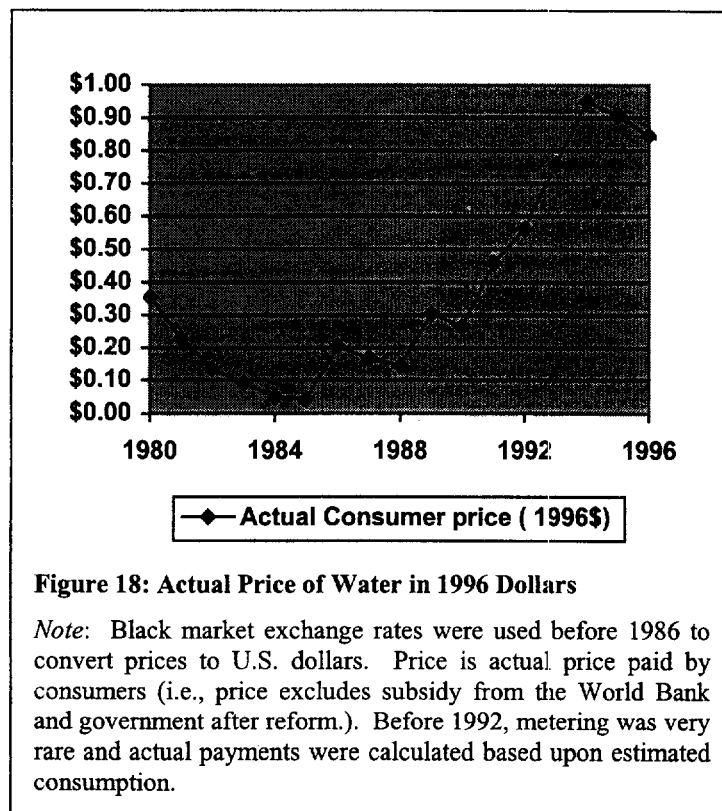
41. Connection and standpipe data from World Bank (1987, p. 38) and World Bank (1989, p. 3).

42. World Bank (1987, p. 38) and World Bank (1989).

43. This is also consistent with assumptions in World Bank documents about sector growth if the Second Water Supply Project had not occurred.

44. Data from World Bank (1987) and World Bank (1989).

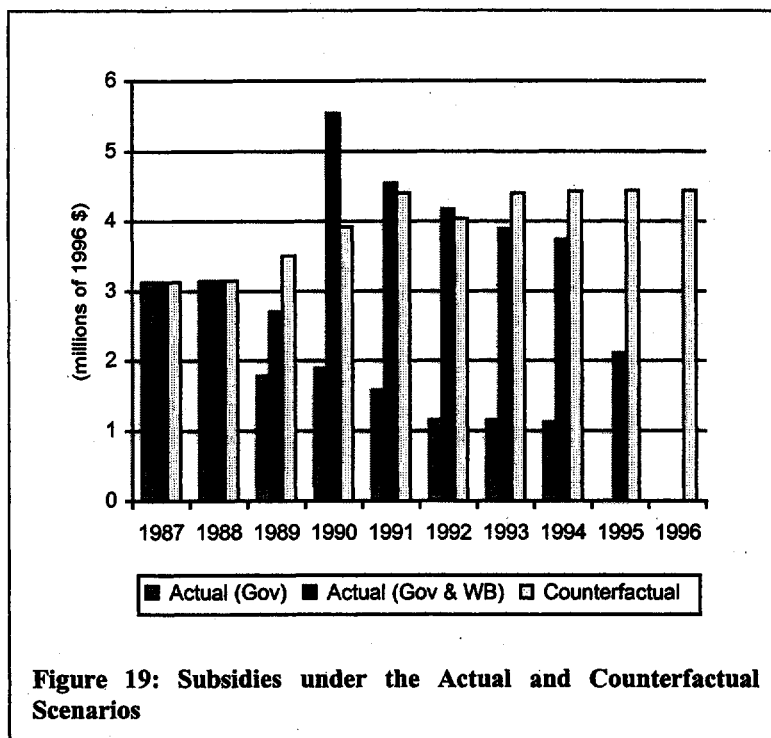
### 4.2.3 Price Effects



improvements in quality. Finally, in the actual scenario, the private operator has an incentive to push the government and SONEG to increase prices. There is no evidence that DEG's management, who had little motivation to push for higher prices since additional revenues would go towards funding the general budget, was pushing for price increases before reform. In fact, most price increases in the 1970s and 1980s appear to have been implemented only under donor pressure. Consequently, under the counterfactual scenario of continued public ownership, we assume that prices would have stayed constant in real terms at the 1988 tariff rate.

As noted earlier, prices were increased significantly following reform (see **Figure 18**). In 1988, the price of water was \$0.14/m<sup>3</sup> in 1996 US\$. By 1994, it was close to a dollar. We assume that the price increase was contingent on reform. This is reasonable for several reasons. First, given DEG's poor collection performance when prices were low, it seems unlikely that DEG would have been able to collect billed amounts if prices were raised significantly. Second, given DEG's poor performance, it seems unlikely that consumers would have borne the price increases without corresponding

#### 4.2.4 Fiscal Effects



Before privatization, DEG was receiving large subsidies from the government, mainly to service sector debt (see **Figure 19**). Despite this, even after considering the subsidies, DEG was losing large amounts of money (**Figure 13**). The large losses that DEG was suffering from would not have been sustainable without additional borrowing or an additional infusion of capital from the government (i.e., an increase in the subsidy). DEG's weak financial position would have made

borrowing very difficult. That is, its financial position was too weak to borrow significant amounts from private capital markets and donors such as the World Bank generally do not lend money to finance operating losses. Therefore, we assume that the government would have slightly increased the subsidy it provides (through capital increases), to make the company's cash flow close to zero. Consequently, subsidies would increase from \$3.15 million in 1988 to \$4.4 million in 1996 (in 1996 US\$). This means that between 1990 and 1992, subsidies including the loan from the World Bank are slightly lower in the counterfactual scenario than they are in the actual scenario. However, subsidies then stabilize at about \$4.4 million in the counterfactual scenario, whereas they drop to zero in the actual scenario. It appears that the subsidies in the counterfactual scenario would be feasible for the government in the medium term. In 1987, the subsidy was equivalent to about 1 percent of government consumption. Under the counterfactual scenario, this subsidy increases to only 1.6 percent of government consumption by 1996.

In summary, there are four major differences between the counterfactual and actual scenarios. First, we assume that the productivity gains observed upon reform would not have been achieved in the counterfactual scenario. Second, we assume that the large investment program observed following reform would not have occurred, but that DEG would have maintained existing assets. Third, we assume that the large price increases that

followed reform would not have been implemented. Finally, given the above assumptions, we assume that the government would have increased subsidies to cover DEG's operating losses. This final assumption is necessary given the first, second and third assumptions.

### 4.3 Projections

The projection period in this analysis is only two years (1997 and 1998), making the time horizon (ten years) comparable with the other case studies.<sup>45</sup> This provides a natural break for the analysis, since the original contract with SEEG lasted for ten years. Further, the renegotiations would make it difficult to predict future outcomes and, in any case, the discount factors applied after 1998 would make future years relatively unimportant.

We make several assumptions for the projection period. First, we assume that prices stay at the 1996 level. This is consistent with the projections of tariffs provided by SONEG in mid-1997. Estimates of future demand are based upon data provided in World Bank (1998). We use SONEG's estimates of investment and fixed capital for these two years. Although it would have been possible to estimate investment and fixed capital based upon past performance for the short projection period, many investment plans and commitments for these two years would have already been fixed before the middle of 1997. Unit costs for other inputs (e.g., for labor and intermediate inputs) are assumed constant in real terms and we estimate quantities of inputs assuming no immediate improvement in productivity. Given the uneven behavior of factor productivity since reform (see Figure 15), this assumption seems reasonable. Finally, we estimate the share of revenues going to SONEG by noting that SONEG is supposed to earn a 2.5 percent rate of return on capital (World Bank, 1989).

In the sensitivity analysis, we use SONEG's projections of output, investment and sector (and company) accounts to re-estimate the gains. The estimates, which were prepared by SONEG in mid-1997, of output were more optimistic than the estimates in the base scenario and, therefore, the gains are larger. In practice, although this affects the size of the gains accruing to each of the partners, it has little effect on relative size or direction of benefits.

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45. See footnote 3.

## **5 Welfare Impact of Reform**

### **5.1 Winners and Losers**

Table 1 presents results from the cost-benefit analysis. Under the base scenario described above, the total welfare gain was over \$33 million (in 1996 dollars). Most of this gain accrued to domestic parties. Even ignoring the presumably large gains due to improvements in service and water quality, private consumers appear to have benefited considerably from reform. Although the large price increase might have reduced the utility of connected customers, especially those disconnected for non-payment, this appears to have been more than offset by gains accruing to new customers. Private consumers who were not able to get connections under DEG were better off paying the high tariff and receiving water than not receiving water at all.

The government benefited considerably in fiscal terms, although the increased price of water meant that the government lost consumer surplus.<sup>46</sup> The drop in consumer surplus for the government contrasts with the increase for private consumers primarily because private consumption increased considerably between 1989 and 1996, while government consumption dropped. That is, since government consumption was not severely rationed before reform, government consumers did not benefit from expanded coverage. It is important to note that the loss in government consumer surplus is calculated based upon the assumption that the government pays its water bill (in time and in full). Since this has not been the case, the 'true' price of water to government is likely to be considerably less than the assumed price in this study. In this respect, the loss in consumer surplus for the government is likely to be considerably smaller than the estimated loss. Foreign buyers also benefited modestly from reform, although their gain was small compared to the gain that accrued to consumers and to the government.

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46. The cost-benefit analysis is likely to underestimate the actual gain due to drop in subsidies. For the first few years following reform, subsidies were higher than they would have been under the counterfactual. However, by 1996, subsidies had been eliminated in the actual scenario, but remained high under the counterfactual. Since the projections only went through 1998 (the last full year of the contract), we ignore these future gains.

**Table 1: Winners and Losers from Reform**

	<i>Total gain (millions 1996 US\$)</i>	<i>Per capita gain (1996 US\$)</i>	<i>Gain (as percent of 1988 output)</i>
<b>Total</b>	<b>\$33.2</b>	<b>\$6.12</b>	<b>126.6%</b>
<b>Total Domestic</b>	<b>\$29.3</b>	<b>\$5.41</b>	<b>111.9%</b>
Government	\$9.8	\$1.81	37.4%
<i>Fiscal Effect</i>	<i>\$17.6</i>	<i>\$3.25</i>	<i>67.2%</i>
<i>Government Consumer Surplus</i>	<i>-\$7.8</i>	<i>-\$1.44</i>	<i>-29.8%</i>
Consumers	\$19.5	\$3.6	74.5%
<b>Foreign Buyers</b>	<b>\$3.9</b>	<b>\$0.71</b>	<b>14.7%</b>

## 5.2 Sensitivity Analysis

In this section of the paper, we explore what effect certain assumptions have on the distribution and level of gains. Three of the alternate scenarios concern parameters in the demand equation, one concerns treatment of the management fee that SEEG pays to the foreign buyers and two concern projections. Although the different assumptions affect the magnitude of the gains accruing to various partners in the project, they do not affect the direction of results or the main conclusions of the study.

### 5.2.1 0.35 Elasticity

In the first alternate scenario, the only difference is that the point estimate of the price elasticity of demand from is changed from 0.6 to 0.35. This is similar to the demand elasticities used in the other case studies (see Shirley, Xu and Zuluaga, 2000; Alcazar, Xu, and Zuluaga, 2000; and Alcazar, Abdala and Shirley, 2000).<sup>47</sup> The main effect of this change is to increase the gain to domestic consumers from \$19.5 million to \$41.0 million.

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47. Note that in these cases, coverage was far higher than in this case study. Price increases, therefore, might mainly affect consumption by connected customers rather than new connections. If, as suggested by the results in World Bank Water Demand Research Team (1993), elasticities for new connections are higher than elasticities of demand for consumption by already connected customers, the higher elasticities might be more appropriate in Guinea.

### 5.2.2 0.70 Elasticity

In the second alternate scenario, we move the elasticity in the opposite direction, making it equal to the estimate for the elasticity of new connections with respect to the monthly bill for Brazil and Pakistan (0.7). This has the opposite effect, reducing consumer surplus for both the government and for private consumers. However, private consumer surplus remains positive under this scenario.

### 5.2.3 Excess Demand

In the base scenario, we assume that total demand is satisfied at the observed price in the actual scenario in 1998. This assumption, however, might not be attractive since SONEG had not extended the distribution network far enough to reach all areas of Conakry (or all areas of other cities). In this alternate scenario, we assume that the actual demand at the observed prices in 1998 would be approximately equal to the demand assumed by SONEG in their projections. The main effect that this has is to increase consumer surplus considerably. The intuition behind this change is that assuming excess demand shifts the demand curve outwards relative to the base scenario. This increases consumer surplus more in the actual scenario because actual quantity consumed is far larger than in the counterfactual scenario. That is, since the demand curves are the same in the two scenarios the increase in area under the demand curve is greater in the actual scenario since the quantity consumed is greater. Assuming greater excess demand would lead to a greater increase in consumer surplus.

### 5.2.4 Management Fee

In addition to ownership of SEEG, the foreign owners also signed a management contract to provide home-office support for SEEG's operations (e.g., data processing, water treatment, etc.) The contract allows remuneration for this support to be set at 2 percent of SEEG's revenues (World Bank, 1989, p. 9). To the extent that these costs represent real costs to the foreign companies, they should not be treated as returns to the foreign owners. However, it is possible that the entire fee was not used to cover real costs. In this scenario, we treat the entire 2 percent fee as if it were a transfer to the foreign owners (i.e., that they provided nothing real in return for the fee). Since the foreign buyers presumably provide some services in return for the fee, this provides an upper bound on the gain to foreign buyers. This marginally increases the gain to the foreign owners.

### 5.2.5 SONEG's Projections

As noted above SONEG also provided us with projections of revenues, costs, capital expenditures, quantities sold, etc. In general, the main difference was that the quantities of water sold (and, therefore, revenues from sales) were larger than the

quantities projected in World Bank (1998). Again, although the gains are larger than in the base case, they are qualitatively similar.

#### 5.2.6 SONEG's Revenue Projections with World Bank Quantity Projections

Finally, we repeat the previous exercise using SONEG's projections of revenues, costs, etc., but using the World Bank's projections of quantity of water sold. To keep revenues the same as in SONEG's projections we increase prices. This leads to smaller (although still positive) gains to consumers and larger gains to the government and foreign investors. The net gain is close to the net gain in the base scenario.

**Table 2: Winners and Losers from Reform under Different Model Assumptions**  
(millions 1996 US\$)

	<i>0.35 Elasticity</i>	<i>0.70 Elasticity</i>	<i>Excess demand</i>	<i>Manage- ment fee</i>	<i>SONEG projections</i>	<i>SONEG projections w/ World Bank quantity</i>
<b>Total</b>	<b>\$56.2</b>	<b>\$28.4</b>	<b>\$38.7</b>	<b>\$34.2</b>	<b>\$44.2</b>	<b>\$32.1</b>
<b>Total Domestic</b>	<b>\$52.3</b>	<b>\$24.5</b>	<b>\$34.8</b>	<b>\$29.3</b>	<b>\$39.5</b>	<b>\$27.1</b>
Government	\$11.3	\$9.5	\$9.8	\$9.8	\$11.5	\$12.0
<i>Fiscal Effect</i>	<i>\$17.6</i>	<i>\$17.6</i>	<i>\$17.6</i>	<i>\$17.6</i>	<i>\$19.3</i>	<i>\$19.2</i>
<i>Government Consumer Surplus</i>	<i>-\$6.3</i>	<i>-\$8.1</i>	<i>-\$7.8</i>	<i>-\$7.8</i>	<i>-\$7.8</i>	<i>-\$7.2</i>
Consumers	\$41.0	\$15.0	\$25.0	\$19.5	\$28.0	\$15.1
<b>Foreign Buyers</b>	<b>\$3.9</b>	<b>\$3.9</b>	<b>\$3.9</b>	<b>\$4.9</b>	<b>\$4.7</b>	<b>\$5.0</b>

## 6 Conclusion

In summary, most indicators show that performance has improved significantly since reform. Water and service quality has improved and coverage has increased modestly. In addition, all measures of productivity have increased, SEEG has recorded modest profits since the reform and government subsidies were eliminated following the end of the transition period. Although after initial gains in productivity, improvements appear to have stalled or reversed, the decline is probably primarily due to the large expansion in productive capacity, which was completed before the corresponding increase in distributive capacity. Consequently, since there is excess capacity for production, as new connections come on line, productivity is likely to improve again. The increase in the



number of connections in 1997, which resulted in a noticeable increase in connections/employee, strongly suggests that this is the case.<sup>48</sup>

The cost-benefit analysis supports the view that sector performance has improved since reform. Although the different scenarios present different estimates of the total gain from reform, qualitatively they are similar. The government gains through the effect that reform has on its finances, but loses consumer surplus. In aggregate, consumers gain from reform, although the magnitude of the gain is somewhat sensitive to different model assumptions. Consumers gained through expanded coverage, which more than made up for the loss they faced due to increased prices. Finally, the foreign buyers gained only a modest amount from reform compared to either consumers or the government. These estimates are likely to underestimate the true gains from reform (to consumers and to the government) for several reasons. First, we ignore any gains from improved service and water quality. In practice, the improved quality (i.e., by making water potable) is likely to have been one of the most significant gains to consumers. Second, we ignore any externalities related to improved health. Although it is not clear how large these gains are likely to have been, since there was no related expansion of the sewerage network, they might have been substantial.<sup>49</sup> Finally, we treat DEG's accounts as if they truly reflect DEG's performance before reform. In practice, they are likely to overstate DEG's success and, therefore, we are likely to overstate DEG's probable performance in the counterfactual. Therefore, we conclude that there were large gains compared to any reasonable assumptions about performance under continued public ownership.

Although, as noted above, most performance indicators have improved, some problems remain. The three most troublesome areas are unaccounted for water, poor collection rates and high prices. Although unaccounted for water is high, this might not be a major concern since potential production is currently far higher than current consumption. Since the marginal cost of water (primarily for treatment) is relatively low, it might not be worthwhile to do expensive repairs when the system is not capacity constrained. The other two concerns are related. Collection, although improved since the period of public ownership, remains poor from both the private and the public sector. Between 1990 and 1996, provisions for unpaid bills accounted for about 20 percent of sector revenues. Although the weak institutional environment makes it difficult to increase collection rates, there are some steps that the government could take to reduce this problem. First, the government could ensure that it pays its own bills on time – the government accounted for about 30 percent of total sales in 1996 and, therefore, could

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48. The number of SEEG employees has also continued to increase, however, reaching over 500 employees by the end of 1999 (World Bank files).

49. Ménard and Shirley (2000) notes that gains in health are greater when both sewerage and water service are provided.

reduce the billing problem simply by paying its own bill. In addition, legislation allowing SEEG to collect unpaid bills from private individuals might help SEEG boost the collection rate. If the government took these actions, it would go a long way towards lowering prices.

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